



The

Monthly Evening Sky Map

A SCIENTIFIC JOURNAL AND EDUCATIONAL GUIDE IN ASTRONOMY FOR THE AMATEUR

Founded in 1905 by Leon Barritt

ALSO A STAR, CONSTELLATION AND PLANET FINDER MAP ARRANGED FOR THE CURRENT MONTHS - MORNING AND EVENING - AND PRACTICAL ANYWHERE IN THE WORLD
PUBLISHED QUARTERLY

Largest Circulation of any Amateur Astronomical Journal in the World

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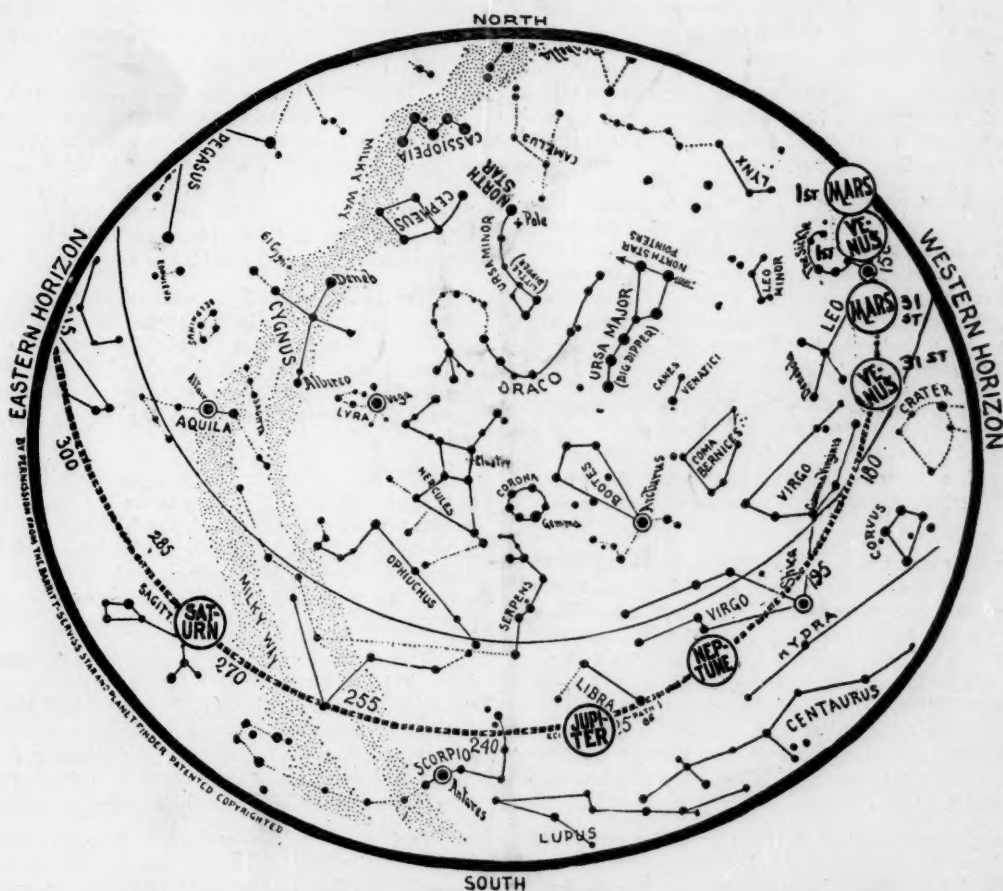


Vol. LIII Whole Number 501

RUTHERFORD, N. J., JULY - AUGUST - SEPTEMBER, 1959

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EVENING SKY MAP FOR JULY



AT 9:30 P.M., JULY 1

8:30 P.M., JULY 15

7:30 P.M., JULY 31

Face South and hold the Map overhead, the top North, and you will see the stars and planets just as they appear in the heavens. The arrow through the two stars in the bowl of the Big Dipper points to the North Star, the star at the end of the handle of the Little Dipper.

This map is arranged specifically for Latitude 40 North—New York—but is practical for ten or fifteen degrees north or south of this latitude anywhere in the United States, the southern portion of Canada and the northern portion of Mexico and for corresponding latitude in Europe.

A GLIMPSE OF THE INFINITE

BY HAROLD STEELE, *St. Petersburg, Fla.*

Who can contemplate the wonders of a starry night without a feeling of awe, mingled with a desire to know the answers to a score of questions? If you attempt to find the answers by delving into the mysteries of the stars, one of the first things you will find out is that the distances that separate them are completely incomprehensible. The human mind simply is not capable of understanding the vastness of the Universe.

Equally impossible, no matter how much you tax your imagination, is it to grasp the idea of speed as it relates to the movements of the celestial bodies, nor can we have more than a restricted conception of the dimensions of the stars.

The man-made satellites now encircling the Earth travel at approximately 18,000 miles an hour. That is 300 miles a minute or five miles each second. Try to picture an object speeding passed you fast enough to be five miles away while you count: one, two, three, four; rather quickly. It's a speed that is difficult to imagine.

But that is almost slow-motion compared to the speed of The Great Comet of 1843 which traveled a million miles an hour, or about $277\frac{3}{4}$ miles each second.

An automobile going one mile an hour, and another moving fifty-five miles an hour will give you a fairly accurate comparison of the speed ratio between a man-made satellite and The Great Comet.

We can better realize the magnitude of celestial distances if we associate them with simple, understandable, human experiences. Few people would drive their car 100 miles an hour, even if the law and traffic conditions would permit. Yet an infant, starting on a journey to the Sun, traveling at this rate of speed twenty-four hours a day, 365 days a year, would not live long enough to get there. It would take more than 106 years.

Still, the 93,000,000 miles from the Earth to the Sun is just a "stones throw" compared with the distance to the nearest star, Alpha Centauri, which is 272,000 times as far. The 100-mile-an-hour vehicle on a trip to this star would take well over twenty-eight million years to reach its destination.

Now, let's really go out into space. Beyond the Milky Way, in which our solar system is located, we can peer into space through the 200-inch Hale telescope, two billion light years, or 11,750,313,600,000,000 miles. Can you even read such a figure, let alone having any idea of how far it is? (It is 11 sextillion, 750 quintillion, 313 quadrillion, 600 trillion.) That is why astronomers measure distances in light years rather than in miles. A light year is the distance traveled by light in one year at 186,300 miles a second, or 5 trillion, 875 billion, 156 million, 800 thousand miles.

Distances measured in light years are as incomprehensible as those measured in miles, but they are easily expressed and for purposes of comparison with one another, more readily understood.

The Andromeda nebula, a whirling spiral of countless stars, comparable to our Milky Way, is one of an estimated 100 million similar systems within a distance of 500 million light years from the Earth. Although it is 850,000 light years away, its tremendous size and luminosity make it visible to the naked eye under favorable conditions. What we

see, however, is not the Andromeda nebula as it actually is today, but as it was 850,000 light years ago, since the light that is now reaching us has taken that long to get here.

It should be stated parenthetically that all the dimensions, speeds and distances mentioned in this article pertaining to the stellar system are more or less rough estimates, and represent a happy medium gleaned from the sometimes widely varying opinions found in the several volumes on astronomy consulted during research for this article. Figures pertaining to the solar system are approximate.

Most of the extragalactic nebulae—that is, star systems outside of our own Galaxy—cannot of course be seen with the naked eye. It may be true that most of them cannot be seen even with the most powerful telescope, for who knows what is beyond?

Now, let's return to our own neighborhood. The Milky Way is a whirling watch-shaped Galaxy of from thirty to fifty billion stars, of which our Sun is one. Our solar system is located a little more than half-way from the center to the edge of the Milky Way, which has a diameter of about 100,000 light years, and a thickness one-tenth of its diameter.

The Earth is indeed tiny in comparison with the Sun. Yet, to use the illustration mentioned before, it would take our 100-mile-an-hour vehicle $79\frac{1}{4}$ hours to go through its center at the equator. Just imagine yourself behind the wheel of your car, racing 100 miles an hour for more than three days and three nights without a stop. Looking at it in this way, the Earth is not so small. But it would take 1,300,000 earths to fill a sphere as large as the Sun.

Yet the Sun is small in comparison with the star Betelgeuse. If the Sun were located at the center of Betelgeuse, the four planets, Mercury, Venus, Earth and Mars, could follow their orbits around it and still keep well within the confines of that colossal star. Bear in mind that the average distance of Mars from the Sun is 141,500,000 miles!

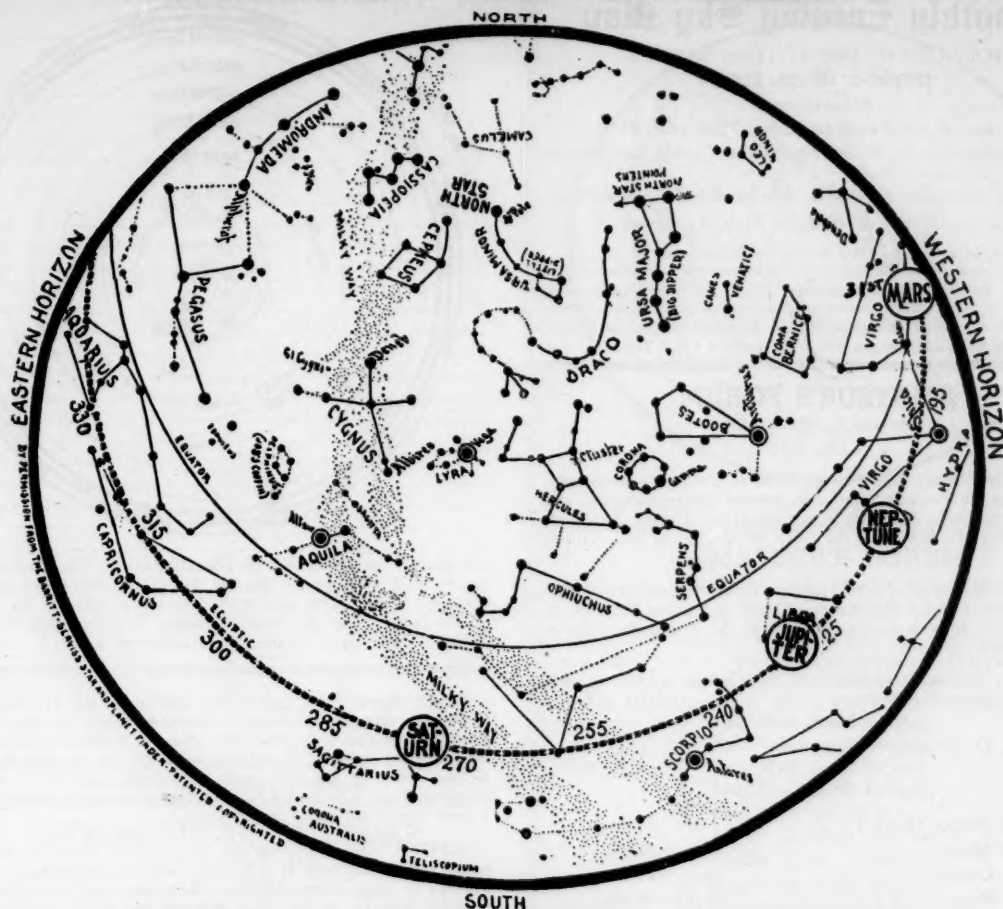
Without motion the Universe would collapse because of the gravitational pull of the planets and stars. The Moon revolves in its orbit at just the right speed to prevent it from colliding with the Earth and to keep it from wandering off into space. The speed of the Earth in its orbit around the Sun, offsets the Sun's gravitational pull and prevents a similar catastrophe.

The closer a planet to its center of attraction, the faster it must move in its orbit to counter-balance that attraction. Mercury, which is less than half the Earth's distance from the Sun, moves in its orbit nearly thirty miles a second (the Earth's orbital speed is eighteen and one-half miles) and completes a little more than four revolutions around the Sun while the Earth is making only one.

To illustrate this point further: Pluto averages nearly forty times the Earth's distance from the Sun. At this point the reduced effect of the Sun's gravitation permits Pluto to pursue its course at the leisurely pace of three miles a second (one-tenth the speed of Mercury) taking 248 years to complete just one revolution around the Sun. The orbital distance of Pluto from the Sun, incidentally, varies more than any other planet. Its maximum distance is 4 billion, 600 million miles, and its minimum, 2 billion, 760 million miles.

(Continued on Page 8)

EVENING SKY MAP FOR AUGUST



AT 9:00 P.M., AUG. 1

8:00 P.M., AUG. 15

7:00 P.M., AUG. 31

Face South and hold the Map overhead, the top North, and you will see the stars and planets just as they appear in the heavens. The arrow through the two stars in the bowl of the Big Dipper points to the North Star, the star at the end of the handle of the Little Dipper. This map is arranged specifically for Latitude 40 North—New York—but is practical for ten or fifteen degrees north or south of this latitude anywhere in the United States, the southern portion of Canada and the northern portion of Mexico and for corresponding latitudes in Europe.

ANNOUNCEMENT

Beginning with the October 1959 issue of the *Monthly Evening Sky Map*, the magazine will be published under new auspices. The pressure of other activities has precluded the current editor-publisher's abilities to meet the potential of the rapidly expanding interest in the heavens, and he must announce with some reluctance, but with a dash of optimism for the magazine's future, the transfer of the *Monthly Evening Sky Map* to new owners.

The new editor and publisher, who will assume his duties and ownership with the October issue, is Mr. Donald D. Zahner of St. Louis. Mr. Zahner has been an active amateur astronomer for nearly 25 years, and is a long-time member of such organizations as the American Association of Variable Star Observers, the Association of Lunar and Planetary Observers, and the British Astronomical Association. He is a board member of the St. Louis Astronomical Society and is director of the St. Louis "Operation Moonwatch" Station, operating under the jurisdiction of the Smithsonian Astrophysical Observatory Satellite-Tracking Program.

Mr. Zahner assumes his position with a broad background in writing, editing, advertising and promotion, as well as formal college training in basic astronomy. Assisting Mr. Zahner as associate editor will be Dr. Armand Spitz, director of Spitz Laboratories and designer of the world-famous Spitz Planetariums. Dr. Spitz is prominent in both amateur and professional circles, and has to his credit an extensive reputation in the field of science and museum education, as well as hundreds of published articles and books. He is author of the currently publicized *Dictionary of Astronomy and Astronautics*, described by reviewers as the definitive work in its field to date.

It is interesting to note that Armand Spitz was appointed associate editor shortly after the death of the original editor and publisher, Leon Barrit, exactly 20 years ago, a capacity in which he served until Mrs. Barrit was able to step into the position vacated by her husband's passing.

New plans for the revised and expanded *Monthly Evening Sky Map* will be covered in the October issue, and will include regular features by such well known telescope and observational authorities as Tom Cave, Jr., and Walter Scott Houston. More details will be forthcoming with the next issue.

It is with sincere regret that the undersigned relinquishes this wonderful publication. However, the pressures of the duties of a corporation executive do not mix with publishing, and have made it increasingly difficult to devote the proper time to the "MAP". I apologize to the irate subscribers who justifiably complained of delays; and I thank gratefully, those who have written wonderful letters of encouragement. On behalf of Maria Barritt, who retired in 1955, and myself, I wish well deserved success to THE MONTHLY EVENING SKY MAP and its new management. Vale!

IRVING L. MEYER

IMPORTANT NOTICE

Effective July 1, 1959, kindly address all communications to:

THE MONTHLY EVENING SKY MAP

415 Carrswold Drive

Clayton 5, Missouri

The Monthly Evening Sky Map

FOUNDED IN 1905 BY LEON BARRITT

IRVING L. MEYER, EDITOR

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Add five hours to convert to Greenwich Civil Time.

AMATEUR'S FORUM

BY IRVING L. MEYER, M. S.

JULY, 1959

THE SUN: shortly past its high point in the northern heavens, moves at an increasingly rapid rate toward the equator and the southern hemisphere. It travels from Gemini into Cancer. The earth is in *aphelion* (farthest from the Sun) on the 5th, at 94.5 million miles.

THE MOON: is at *apogee* (farthest from the earth) twice this month, on the 1st at a distance of 252,000 miles, and the 29th at 251,000 miles. It is at *perigee* (closest to the earth) the 17th at 226,000 miles.

Libration: Maximum exposure of the regions on the Moon's limbs takes place as follows:

July 6 North limb, 6.6°
July 10 East limb, 5.5°
July 19 South limb, 6.5°
July 23 West limb, 6.4°

The Moon's Phases (E.S.T.):

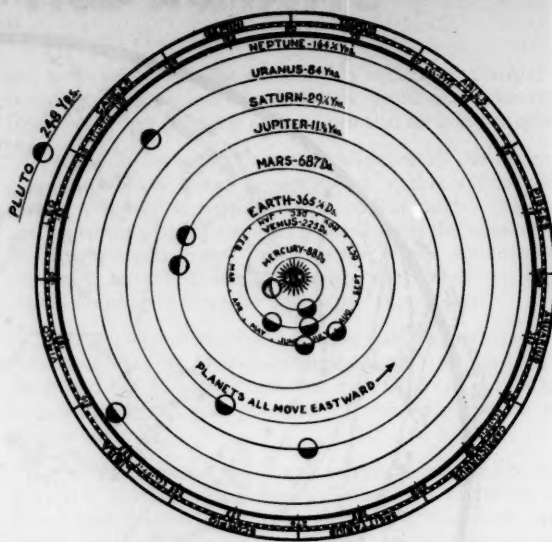
New Moon	July 5 at 9:00 pm
First Quarter	13 at 7:01 am
Full Moon	19 at 10:33 pm
Last Quarter	27 at 9:22 am

MERCURY: in the evening sky all month, it moves from Cancer just over the Leo boundary, thence back into Cancer. It reaches greatest elongation from the Sun, 26° 14', on the 8th, and for a few days around this date can be seen in the evening twilight, low in the western skies. Magnitude, 0.7, is relatively weak for an elongation. Diameter is 8", and illumination is about 40%—crescent. This planet is best seen in full daylight with a circle-equipped telescope of good-sized diameter; even then, however, the disc is devoid of detail. Distance decreases during the month from 90 million to 55 million miles.

VENUS: undisputed queen of the skies all spring, particularly from the northern hemisphere, this brilliant planet continues to hold sway. Though the illuminated disc decreases from 45% to 23% during the month, distance also decreases from 60 million miles, to 39 million miles, with consequent increase in apparent diameter from 26" to 41". Greatest brilliancy is achieved on the 26th, at magnitude -4.2—far brighter than any other planetary or starlike object in the heavens, the Sun and the Moon excepted. Any telescope will show the crescent-shaped disc, though, like Mercury, daylight observations are best since the tremendous brilliance of the planet is thereby reduced.

A rare event takes place on the morning of the 7th, when Venus occults (passes directly in front of) Regulus, the beautiful first magnitude star in Leo. On the evenings of the 6th and 7th, the two will be very close together and will shine almost as a bright double star. The actual occultation occurs in daylight as far as the eastern part of North America is concerned, since conjunction in Right Ascension takes place at about 9:31 am, E.S.T. To determine your local possibilities of seeing this phenomenon (for which, also, a good-sized telescope is a must), Venus rises at about 8:20 am local time, or about 3¼ hours after the Sun. The writer's rough calculations indicate that Regulus will disappear at the dark limb of Venus at 9:24 am, and will reappear at the bright limb at 9:36 am (E.S.T.). Parallax can change these times a little, but they should be good enough for practical purposes.

HELIOCENTRIC POSITIONS OF THE PLANETS, JULY



The planets are shown in their respective orbits. Two positions, one for the first, and one for the last day of the month are given for Mercury, Venus, Earth, and Mars. The arrow indicates the last day of the month. Jupiter, Saturn, Uranus, Neptune, and Pluto are shown in their mean position for the current month.

MARS: moves from Cancer into Gemini in the evening sky. It is now an unimportant second magnitude object, setting so close after the Sun that it is difficult to observe. Furthermore, it is very far from the earth—215 million miles the 1st, increasing to 229 million miles by the 31st, with consequent decrease in apparent diameter from 4.04" to 3.80". In the telescope it would appear almost exactly the same size as Uranus.

JUPITER: shares evening sky honors with Venus in the early hours, and Saturn later. It is in Libra, averages magnitude -1.9, and exhibits so large a disc that even binoculars will reveal it. Equatorially, diameter is 42", but through the poles rapid rotation flattens the disc to 39". This flattening is readily apparent with the smallest optical aid. The four main satellites are easy to see with small telescopes or binoculars. See elsewhere in this issue for charts of their motions. Distance the 15th is 444 million miles.

SATURN: another lord of the night skies, it is in the star-strewn area of Sagittarius, far south of the equator. The ring system, unique and beautiful, is wide open as seen from the earth. The smallest telescope or binoculars will reveal that this planet is no ordinary disc; with 50 or 100 diameters on a medium sized telescope, the ring system can be seen in all its glory, including Cassini's "Division". Also, several of the larger and brighter satellites, Titan principally, can be seen with moderate sized telescopes. On the 15th, magnitude is 0.3, ring diameter is 41", diameter of the disc of the planet itself is 18", and distance is 845 million miles.

URANUS: in the evening sky in Cancer, close to the Leo boundary, is too close to the Sun all month to be observable. At best this is a faint, barely visible to the naked eye object. Distance the 15th is 1798 million miles.

NEPTUNE: well south of the equator, in Virgo, sets shortly after midnight. This is the first truly telescopic planet—magnitude 8—despite its great size. Distance is enormous, 2796 million miles the middle of the month, resulting in an apparent diameter of only 2.4". This disc can be made out with a power of 100 diameters, but the disc is dull and uninteresting.

Another rare event takes place on the 21st, when Neptune arrives at *aphelion* (its farthest point from the Sun). This is the first time the planet has been in aphelion since its discovery, and the next arrival at aphelion will be in the year 2124! Actually, the orbit of Neptune is very close to a true circle; only the orbit of Venus is less eccentric, whereas that of our own earth departs from the circle twice as much as does Neptune. On the 21st Neptune is 30.33 astronomical units distant from the Sun, corresponding to 2,817,700,000 miles. Its *perihelion* distance is only some 51 million miles less than this, which is very minor when compared to the planet's tremendous mean distance.

SATELLITES OF JUPITER

JULY

Day	West	East
1	○1	○ -2 3- -4
2		○ -1 3- -4
3	2- 3- ○	4-
4	3- 1- ○	-1 4- -2 ●
5	-3 1- ○	2- 4-
6	2- 1- ○	1- 4-
7	-2 1- ○	-3
8	4- ○	1- 2 3-
9	4- ○	2- 3- -1 ●
10	4- 2- 1- ○	
11	-4 3- ○	-1 -2 ●
12	-4 -3 1- ○	2-
13	-4 -3 1- ○	2-
14	-4 -3 1- ○	2-
15	-4 -3 1- ○	2-
16	-4 -3 1- ○	2-
17	-4 -3 1- ○	2-
18	-4 -3 1- ○	2-
19	-4 -3 1- ○	2-
20	-4 -3 1- ○	2-
21	-4 -3 1- ○	2-
22	-4 -3 1- ○	2-
23	-4 -3 1- ○	2-
24	-4 -3 1- ○	2-
25	-4 -3 1- ○	2-
26	-4 -3 1- ○	2-
27	-4 -3 1- ○	2-
28	-4 -3 1- ○	2-
29	-4 -3 1- ○	2-
30	-4 -3 1- ○	2-
31	-4 -3 1- ○	2-

Appearance of Jupiter and its satellites at 10:30 P.M., E.S.T.
as seen in an inverting telescope

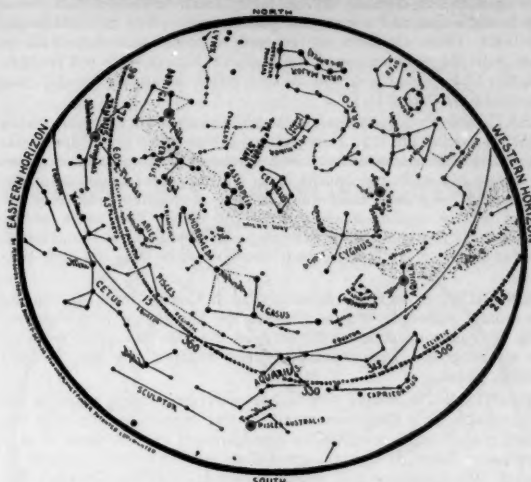
ASTRONOMICAL CALENDAR

Eastern Standard Time

JULY, 1959

July 3— 2:05 am	Minimum of Algol
5— 2:— am	Earth in aphelion
5—10:54 pm	Minimum of Algol
7—10:— am	Mercury in descending node
8— 5:28 am	Conjunction, Mercury and Moon; Mercury north 4° 6'
8—11:34 am	Conjunction, Uranus and Moon; Uranus north 4° 47'
8— 4:— pm	Mercury greatest elongation east, 26° 14'
8— 7:43 pm	Minimum of Algol
9— 3:34 am	Conjunction, Mars and Moon; Mars north 4° 51'
9— 5:31 pm	Conjunction, Venus and Moon; Venus north 3° 18'
11— 9:— am	Venus in descending node
11— 4:32 pm	Minimum of Algol
12— 3:— pm	Conjunction, Mercury and Uranus; Mercury south 1° 48'
14— 6:21 am	Conjunction, Neptune and Moon; Neptune south 0° 32'
14— 1:21 pm	Minimum of Algol
15—11:36 am	Conjunction, Jupiter and Moon; Jupiter south 2° 43'
17— 5:— am	Neptune stationary in Right Ascension
17—10:10 am	Minimum of Algol
17— 5:— pm	Mercury in aphelion
18— 6:23 am	Conjunction, Saturn and Moon; Saturn south 4° 8'
20— 6:59 am	Minimum of Algol
20—12: Noon	Jupiter stationary in Right Ascension
21— 9:— am	Neptune in aphelion
21— 7:— pm	Mercury stationary in Right Ascension
23— 3:48 am	Minimum of Algol
26—12:37 am	Minimum of Algol
26— 3:— pm	Venus greatest brilliancy, magnitude -4.2
27— 8:— pm	Quadrature, Neptune and Sun
28— 9:26 pm	Minimum of Algol
29— 6:— am	Conjunction, Mercury and Uranus; Mercury south 5° 29'
31— 6:15 pm	Minimum of Algol

MORNING SKY MAP FOR JULY



At 4:00 A.M., July 1; 3:00 A.M., July 15; 2:00 A.M., July 31

AMATEUR'S FORUM

BY IRVING L. MEYER, M.S.

AUGUST, 1959

THE SUN: moves from Cancer into Leo, descending more and more rapidly toward the southern hemisphere. Distance the 1st is 94.3 million miles, the 31st, 93.8 million miles.

THE MOON: *perigee* occurs the 13th at 229,000 miles, and *apogee*, the 26th, is at 251,000 miles.

Libration: Maximum exposure of the regions on the Moon's limbs takes place as follows:

August 2	North limb, 6.6°
August 6	East limb, 4.7°
August 15	South limb, 6.7°
August 20	West limb, 5.6°
August 29	North limb, 6.8°

The Moon's Phases (E.S.T.):

New Moon	August 4 at 9:34 am
First Quarter	11 at 12:10 pm
Full Moon	18 at 7:50 am
Last Quarter	26 at 3:03 am

MERCURY: retrogrades in Cancer most of the month, moving over the line into Leo toward the close. The very rapid motion of this planet takes it from the evening sky at the beginning of the month, past inferior conjunction with the Sun on the 5th, to greatest western elongation in the morning sky, 18° 25', on the 23rd. Visibility is limited to a few days around the 23rd, in the morning sky, close to the horizon as dawn breaks. For northern hemisphere observers, Mercury can never be seen in a completely dark sky—always there is some evening or morning twilight. On the 23rd, magnitude is 0.3, phase is barely crescent (close to half full, like the Moon at quarter phase), nad diameter is 10". Mercury is closest to the earth the 2nd at 55,000,000 miles.

VENUS: queen of the early evening sky at the beginning of the month, this planet grows slightly fainter during August as it comes closer and closer to the earth, at the same time becoming a thinner and thinner crescent. On the 1st, apparent diameter is 41", distance is 38 million miles, illumination is 22%, and magnitude is -4.2. On the 31st, apparent diameter is 59", distance is 27 million miles, illumination is about 1% (an extremely thin and large crescent), and magnitude is -3.2. By the end of the month it is too close to the Sun to be observable, though a good-sized telescope with setting circles can pick it up in daylight. Venus retrogrades from Leo into Sextans during the month.

MARS: in the evening sky, moving from Leo into Virgo. By this time it is relatively faint and so distant as not to be of great interest. On the 1st distance is 229 million miles, diameter is 3.8"; on the 31st, distance is 238 million miles, and apparent diameter is 3.9". Magnitude is 2. At best this planet is of interest only in sizeable telescopes; as far away as it is now, it is beyond the scope of small instruments.

JUPITER: remains in Libra, setting around midnight. Though far away, this planet is so big that its disc is invariably large, and

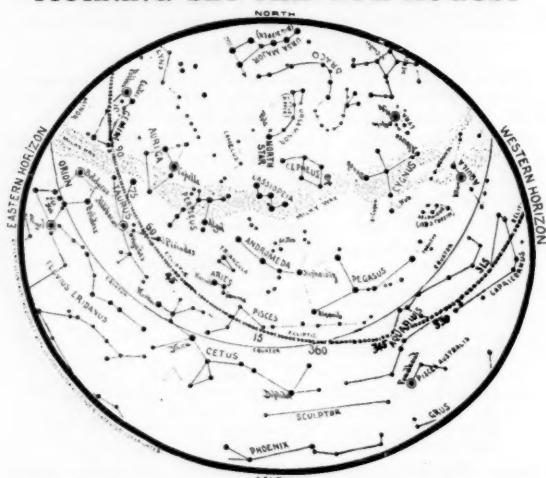
perceptible in binoculars or small telescopes. Well placed for observation in the evening sky. A fairly small telescope will reveal the banded disc, and even opera glasses will reveal the four bright satellites. These satellites, in fact, are so bright that they could be seen with the unaided eye if the brilliant Jupiter were not so near. On the 15th, distance is 486 million miles, magnitude is -1.7, and equatorial diameter is 37".

SATURN: in Sagittarius all month, shines with a bright, steady light, at magnitude 0.5. Though very far away (873 million miles the 15th) this planet and its ring system is so large that it shows up noticeably with any optical help. The apparent diameter of the rings is 40"—greater than the diameter of Jupiter—and they are pretty widely opened as seen from the earth. The globe of the planet itself is about 18" in diameter, and is crossed by cloud bands similar to those of Jupiter, and readily visible in a six-inch telescope.

URANUS: crosses the boundary from Cancer into Leo during the month. However, it is so close to the Sun that it is not observable. It is in conjunction with the Sun the 9th, thereupon entering the morning sky. Maximum geocentric distance, the 9th, is 1805 million miles.

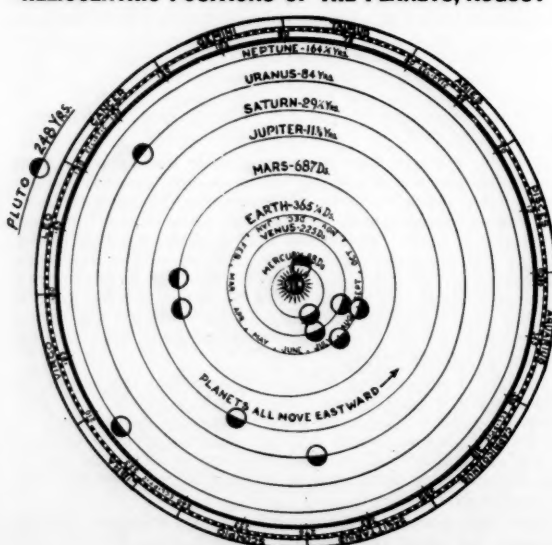
NEPTUNE: in Virgo, sets before midnight from a point in the evening sky. This great but remote planet cannot be seen with the naked eye. A small telescope or good binoculars will show it as a faint starry point of light; a good-sized telescope and a magnification of 100 diameters will reveal a round, dull disc. Distance the 15th is 2844 million miles.

MORNING SKY MAP FOR AUGUST



At 4:00 A.M., Aug. 1; 3:00 A.M., Aug. 15; 2:00 A.M., Aug. 31

HELIOCENTRIC POSITIONS OF THE PLANETS, AUGUST



SATELLITES OF JUPITER AUGUST

Day	West	East
1	3. -2	0. 4. -1 ●
2	3.	1. 0. -2. 4.
3	-3	0. 2. -1. 4.
4	2. 1.	0. 3. 4.
5		0. -1. 3. 4. -2 ●
6	-1	0. 2. 3. 4.
7	2.	0. 1. 3. 4.
8	-2.	0. 1. 3. 4.
9	0. 1.	3. 4. 0. -2.
10		-3. 4. 0. -1. 2.
11	4.	2. 1. 0. -3. ●
12	4.	0. -1. 3. -2. ●
13	4.	-1. 0. 2. 3.
14	-4.	2. 0. 1. 3.
15	-4.	-2. 3. -1. 0.
16		3. 1. 0. -2.
17	-3	-4. 0. 2. -1. ●
18	2.	1. -3. 0. 4.
19		-2. 0. -1. 3. 4.
20		1. 0. -2. 3. -4.
21		0. 1. 3. -4.
22	-2.	1. 3. 4.
23	3.	0. 1. 2. 4.
24	-3	0. 2. 4. -1. ●
25	2.	-3. 1. 0. 4.
26		-2. 4. -1. 3.
27	4.	1. 0. -2. 3.
28	0. 2.	4. 0. -1. 3.
29	4.	-2. 1. 3. 0.
30	4.	3. 0. -2. 1.
31	-4.	-3. 1. 0. 2.

Appearance of Jupiter and its satellites at 9:15 P.M., E.S.T.
as seen in an inverting telescope

Jupiter is represented by the disc in the center of the chart, and each satellite by a dot and its appropriate number. The direction of the satellite's motion is from the dot toward the numeral and light disc at the left margin of the chart indicates a satellite in transit across Jupiter's disc; the numeral and the dark disc at the right margin indicates a satellite which is invisible because it is being eclipsed or occulted by Jupiter. This chart must be held upside down if binoculars, opera glasses, or an erecting type telescope is used.

ASTRONOMICAL CALENDAR

Eastern Standard Time
AUGUST, 1959

August 3—	3:03 pm	Minimum of Algol
4—	12:31 pm	Conjunction, Mercury and Moon; Mercury south 0° 55'
4—	9:11 pm	Conjunction, Uranus and Moon; Uranus north 4° 38'
5—	12: Noon	Inferior conjunction, Mercury and Sun; Mercury south 4° 52'
6—	11:52 am	Minimum of Algol
6—	5:16 pm	Conjunction, Mars and Moon; Mars north 3° 12'
6—	9:55 pm	Conjunction, Venus and Moon; Venus south 2° 55'
7—	1:— am	Mercury greatest heliocentric latitude south
8—	10:— am	Venus stationary in Right Ascension
9—	8:41 am	Minimum of Algol
9—	8:— pm	Conjunction, Uranus and Sun
10—	11:59 am	Conjunction, Neptune and Moon; Neptune south 0° 48'
10—	9:— pm	Conjunction, Venus and Mars; Venus south 6° 46'
11—	6:39 pm	Conjunction, Jupiter and Moon; Jupiter south 3° 5'
12—	5:30 am	Minimum of Algol
14—	11:43 am	Conjunction, Saturn and Moon; Saturn south 4° 19'
14—	8:— pm	Venus in aphelion

15— 2:— am	Mercury stationary in Right Ascension
15— 2:19 am	Minimum of Algol
16— 4:— pm	Quadrature, Jupiter and Sun
17—11:08 pm	Minimum of Algol
20— 7:57 pm	Minimum of Algol
23— 1:— pm	Mercury greatest elongation west, 18° 25'
23— 4:46 pm	Minimum of Algol
26— 2:— am	Mercury in ascending node
26— 1:35 pm	Minimum of Algol
27— 7:— pm	Conjunction, Pluto and Sun
28— 6:— pm	Conjunction, Mercury and Uranus; Mercury south 0° 4'
29—10:24 am	Minimum of Algol
30— 5:— pm	Mercury in perihelion

AMATEUR'S FORUM

BY IRVING L. MEYER, M. S.

SEPTEMBER, 1959

THE SUN: commences the month in Leo, moves south-eastwardly across the equator into Virgo. Distance the 1st is 93.8 million miles, decreasing to 93.0 million miles the 30th.

THE MOON: is closest to the earth the 7th at 229,000 miles, and is farthest the 22nd, at 251,000 miles.

Libration: Maximum exposure of the regions on the Moon's limbs takes place as follows:

September 1 East limb,	4.9°
September 11 South limb,	6.8°
September 16 West limb,	5.3°
September 25 North limb,	6.9°
September 29 East limb,	5.9°

The Moon's Phases (E.S.T.):

New Moon	September 2 at 8:55 pm
First Quarter	9 at 5:07 pm
Full Moon	16 at 7:51 pm
Last Quarter	24 at 9:22 pm

MERCURY: is too close to the Sun all month to be observable. It begins the month in the morning sky, is in superior conjunction with the Sun on the 17th, and thereafter is in the evening sky. It moves through most of the constellation Leo during the month, to a point well inside Virgo. On the last day of the month it is in very close conjunction with Mars, but shines some three magnitudes brighter than the latter. Both objects could be picked up in broad daylight with a well-shielded telescope equipped with setting circles. Mercury is farthest from the earth the 2th at 130 million miles.

VENUS: leaves the evening sky on the very first day of the month, when it is in inferior conjunction with the Sun. It is almost 9° to the south of the Sun, so it actually can be seen in a telescope, as long as the telescope is shielded from the direct rays of the Sun. Venus, with its heavy atmosphere, will look either as a very thin crescent, the arms of which will go more than halfway around the disc, or it might even look like a circlet of light. Its apparent diameter is the greatest of any planet—some 59"—at a closest approach this year of 26.6 million miles. It remains all month in the constellation Sextans, south of Leo.

MARS: too close to the Sun to be observable, it is in the western evening sky setting right after the Sun. In Virgo all month, it is now very far away, and shines as a weak second magnitude. Distance the 1st is 238 million miles, increasing to 241 million miles by the 30th.

JUPITER: in Libra all month, close to the Scorpio boundary, in the evening sky. This bright planet now sets before midnight but, though very far south of the equator, is well placed for observation. Its bright satellite system alone is worth watching, as they change position not only daily, but hourly as seen with modest optical aid. The flattened disc itself has cloud bands across the face, visible under moderate power on a telescope. At the middle of the month, magnitude is -1.5, equatorial diameter is 35", and distance is 529 million miles.

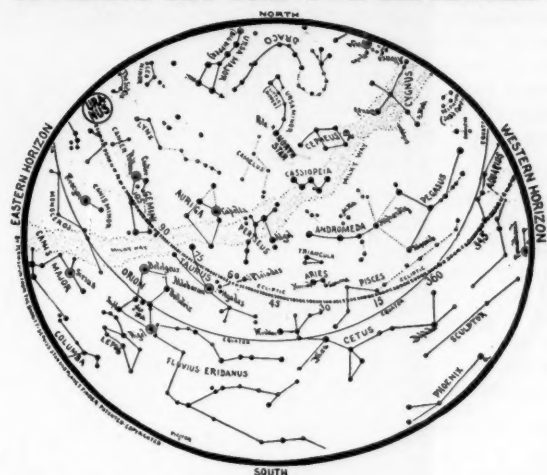
SATURN: sets shortly after midnight, from its position far south of the equator in Sagittarius. This planet shares nighttime honors with Jupiter. Its great distance of 916 million miles on the 15th reduces its brilliancy to 0.7 magnitude, which is still considerably brighter than a standard first magnitude star, though a full magnitude fainter than when this planet is at opposition at time of perihelion. Its rings are not difficult to see with any good optical aid, while a six-inch telescope can even show up Cassini's Division. The rings are close to maximum opening as seen from the earth.

URANUS: in Leo all month, in the morning sky, is rather close to the Sun for ready observation, though its situation improves daily. At best this is a faint planet, just visible to the unaided eye

under ideal conditions. A large telescope (for instance, 12-inch) shows it as a bright, greenish disc, but very small, under 100 diameters. Herschel, in fact, discovered this planet by detecting its appreciable disc as he was scanning the stars with one of his telescopes. Distance the 15th is 1789 million miles.

NEPTUNE: in Virgo, sets not long after the Sun. Since it is an eighth magnitude planet, it can only be seen with optical aid. Under good conditions binoculars are sufficient. It is no longer well placed for observation, particularly from the northern hemisphere. Distance the 15th is 2884 million miles.

MORNING SKY MAP FOR SEPTEMBER



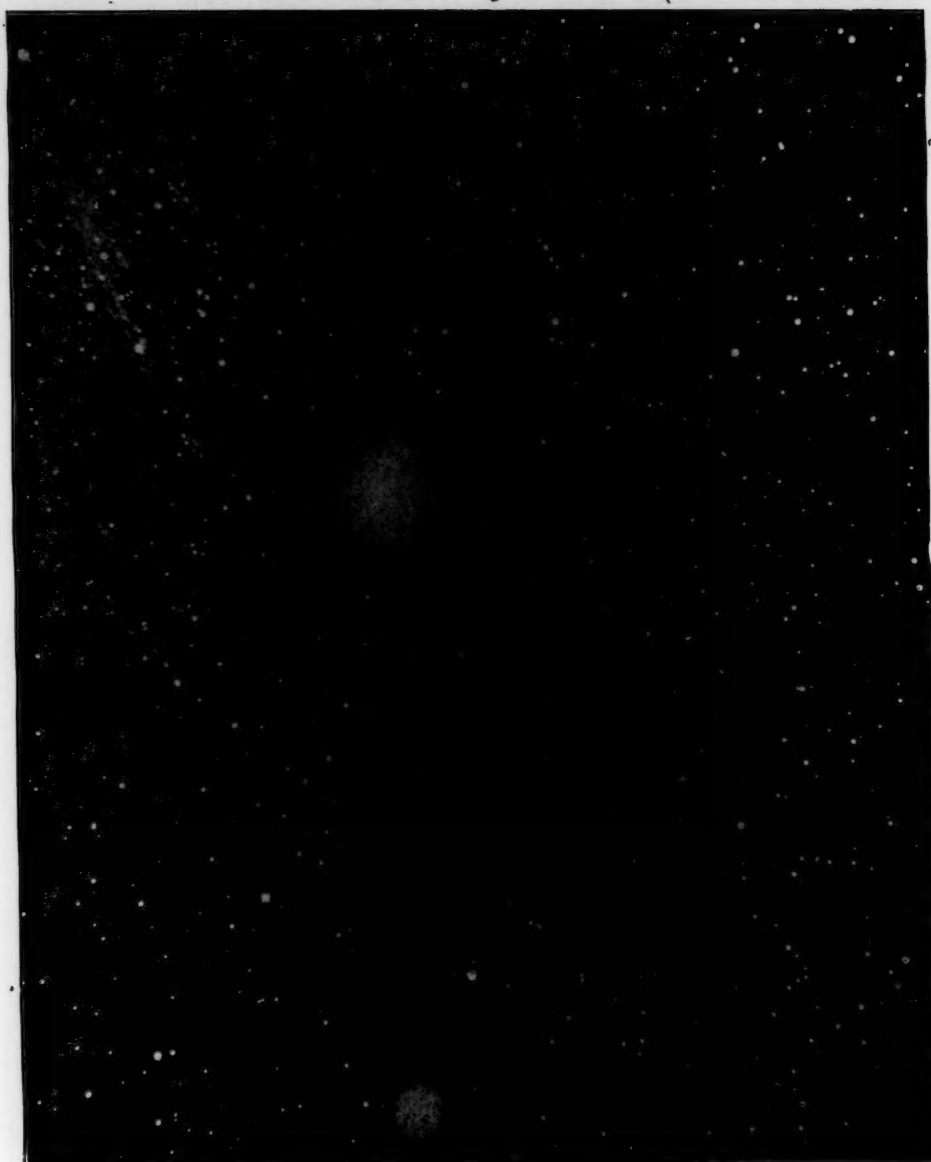
At 4:30 A.M., Sept. 1; 3:30 A.M., Sept. 15; 2:30 A.M., Sept. 30

ASTRONOMICAL CALENDAR

Eastern Standard Time

SEPTEMBER, 1959

Sept. 1— 1:— am	Venus in inferior conjunction with the Sun; Venus south 8° 34'
1— 7:13 am	Minimum of Algol
1— 8:33 am	Conjunction, Uranus and Moon; Uranus north 4° 33'
1— 8:31 pm	Conjunction, Mercury and Moon; Mercury north 4° 46'
2—12:03 pm	Conjunction, Venus and Moon; Venus south 6° 30'
4— 4:02 am	Minimum of Algol
4— 7:12 am	Conjunction, Mars and Moon; Mars north 1° 16'
4— 8:— pm	Saturn stationary in Right Ascension
5— 3:— pm	Conjunction, Mercury and Venus; Mercury north 10° 57'
6— 6:— am	Venus greatest heliocentric latitude south
6— 6:34 pm	Conjunction, Neptune and Moon; Neptune south 1° 0'
6—11:52 am	Minimum of Algol
— 4:40 am	Conjunction, Jupiter and Moon; Jupiter south 3° 29'
9— 8:41 am	Minimum of Algol
9—11:— pm	Mercury greatest heliocentric latitude north
10— 4:56 pm	Conjunction, Saturn and Moon; Saturn south 4° 30'
12— 5:30 am	Minimum of Algol
15— 2:19 am	Minimum of Algol
17— 4:— pm	Superior conjunction, Mercury and Sun; Mercury north 1° 33'
17—11:08 pm	Minimum of Algol
20— 9:— pm	Venus stationary in Right Ascension
23— 4:46 pm	Minimum of Algol
23— 2:09 pm	Sun enters the sign of Libra; Equinox
24— 5:44 am	Minimum of Algol
24— 9:— am	Quadrature, Saturn and Sun
27— 2:33 am	Minimum of Algol
28— 8:45 pm	Conjunction, Uranus and Moon; Uranus north 4° 31'
29— 1:03 pm	Conjunction, Venus and Moon; Venus south 2° 20'
29—11:22 pm	Minimum of Algol
30— 3:— am	Conjunction, Mercury and Mars; Mercury south 0° 10'



THE GREAT NEBULA IN ANDROMEDA (M 31)

"... a whirling spiral of countless stars ... 850,000 light years away, its tremendous size and luminosity make it visible to the naked eye..." (see text).

In addition to the Earth's daily West to East rotation on its axis at about 24,000 miles an hour at the equator, it travels in its orbit around the Sun at the tremendous speed of 67,000 an hour—over 1,100 miles a minute.

The Sun, besides rotating from West to East on its axis once every twenty-five days at the equator and once in every thirty-three days at the poles, moves through space with the whirl of the Milky Way at 43,000 miles an hour, or twelve miles a second, carrying the solar system with it.

The planets of the solar system, six of which have from one to twelve satellites of their own, all move with mathematical precision, counter-clockwise around the Sun, undisturbed by the massive spiral movement of the Milky Way.

The revolution of the Earth *around* the Sun, together with its forward motion along *with* the Sun in the Milky Way spiral, make the actual movement of the Earth through space resemble a coil of wire that has been stretched out from each end.

A man resting beneath a tree on the bank of a lake (near the equator) waiting for a bite at the end of his fishing line, enjoying the beauty and *stillness* of nature, is actually traveling in three directions at once at the incredible, though imperceptible, speeds of: 24,000 miles an hour with the Earth turning on its axis; 67,000 miles an hour due to the Earth's revolution around the Sun; and 43,000 miles an hour with the whole solar system in its forward movement within the Milky Way.

Let us think of the Milky Way a unit rotating on its axis. It is estimated that the period of one complete rotation of the Milky Way itself, at the Sun's distance of a little more than half way from the center to the edge, is 200 million years. A simple calculation tells us that our solar system has made but fifteen complete trips around the center of the Milky Way in its three-billion-year history.

Beyond our Milky Way, extending into infinite space, there are untold millions of similar systems. They are called galaxies, nebulae and island universes, each one with countless stars of its own.

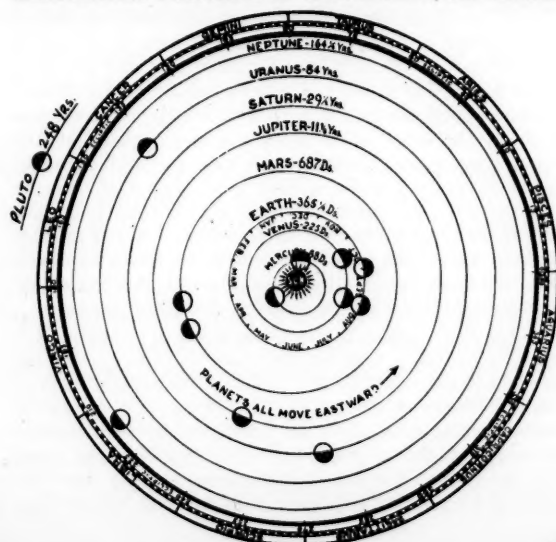
A starry night is nature's most impressive spectacle. It presents perfect order, balance and beauty, on the grandest scale. It is a glimpse into the realm of the infinite.

SATELLITES OF JUPITER SEPTEMBER

Day	West	East
1	4	10
2	4	3
3	4	2 3
4		3
5	2 1	4
6	3	1
7	3	2
8	3 2	1
9	2	4
10	1	2 3
11		3
12	2 1	4
13	4 3	2 1
14	4 3	1
15	4	3 2
16	4	2 1
17	1	2 3
18	4	1 2
19	4 3	1
20	3	2 1
21	3	1
22	2	3 4
23	2	1
24		2 3
25		2 3
26	2	3
27	3	1
28	3	1
29	3	1

Appearance of Jupiter and its satellites at 7:45 P.M., E.S.T.
as seen in an inverting telescope

HELIOCENTRIC POSITIONS OF THE PLANETS, SEPTEMBER



NEBULA AND STAR CLUSTER

There is a little significant patch of light to which we would call your attention. Near the meridian at map time and close to the brilliant star Vega in Lyra, lies the rather unimposing constellation of Hercules, which contains no first magnitude stars; but it does contain one of the finest, if not the very finest, star-cluster in the heavens. It can be seen without a telescope on very clear moonless nights, but its true nature cannot be discovered without one.

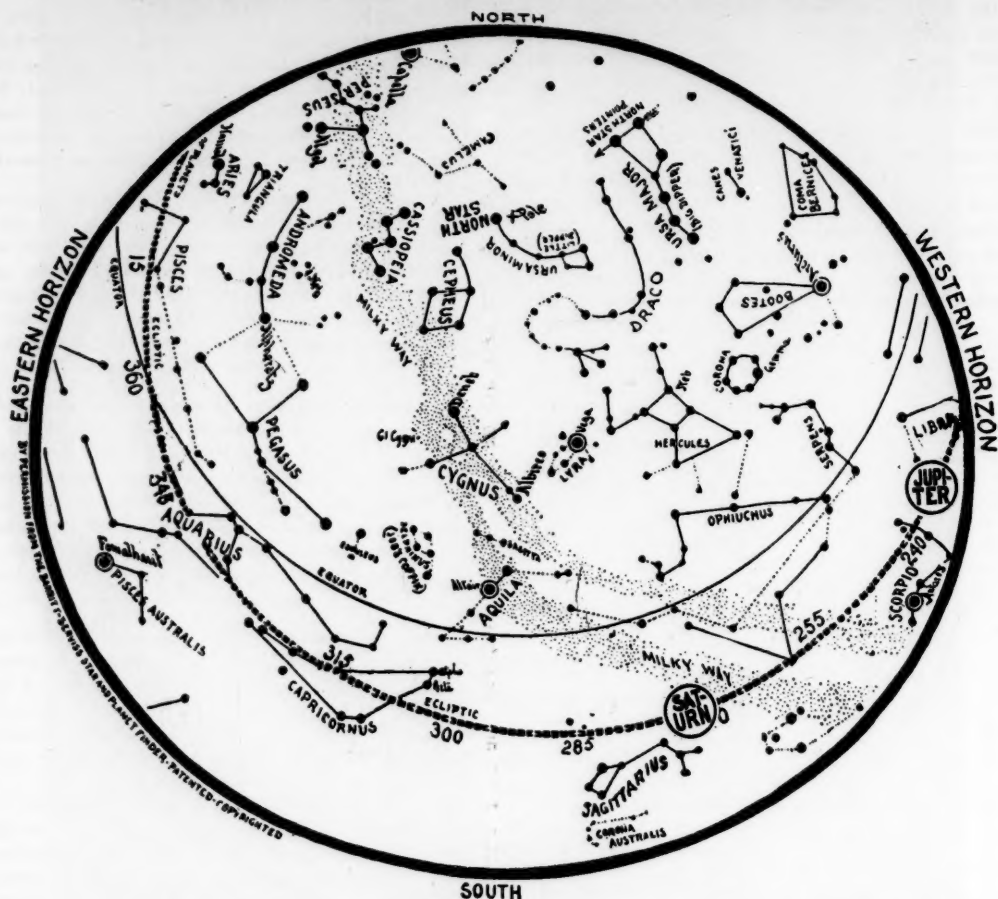
It takes only a small telescope—even one of three inches will easily do. Comprised within that fuzzy looking little star are really no less than 5,000 stars, all of a size comparable with that of our sun! When you consider the enormous distance that separates us from this cluster, which Shapely found to be probably about 36,000 light years away, the great volume occupied by it and the really large distance which separate the component stars, so close to one another in the telescope, may perhaps be appreciated.

According to the same astronomer, the so-called globular clusters, of which this is one, are all arranged symmetrically about the plane of the Milky Way or Galactic Plane. This would indicate that it is also their fundamental plane and that, in spite of their staggering distances, for one of them, N.G.C. 7006, has been found to be about 200,000 light-years away, both we and they belong to the very same galactic organization along with every object visible to us in the heavens. The sun and we are members of a local cluster, whose diameter seems to be about 1,000 parsecs or 3,300 light-years.

In the constellation of Andromeda, on the side toward the "W" of Cassiopeia, you will find on the map a little group of dots marked "Neb." This locates the position of another of the marvelous objects in the heavens of which not even a hint is given by the unaided eye, the great spiral nebula in Andromeda. Under good circumstances of observation it can be noted by the eye as a little uncertain patch of light but in the telescope it is seen to occupy an area of sky about half a degree wide and three times as long. For the sake of comparison we remind the reader that the disk of the full moon is about half a degree in diameter. In common with all spiral nebulas, the center of this one is a star-like concentration of matter. Both this nucleus and the outlying matter, which distinctly shows the typical arms of the spiral, send out their own light. The spectroscope has shown that the physical state of the matter composing it must be like that of the sun and most stars, solid or liquid masses surrounded by individual atmosphere of cooler gases. This has been taken to denote that the spirals are themselves immense subdivisions of the universe, composed of stars and thus standing on a par with our galaxy.

There does seem to be some indication that the latter has spiral form, but this is far from definite. We know too little yet about the spiral nebulas. They all have extremely large velocities thru space with respect to our system, greater than that of the stars, and rather definite indications of internal rotations have been obtained. Their distances from us according to the Mount Wilson observer, not as great as those of the globular cluster, at least this is true of the Andromeda nebula. Since these clusters are taken as members of our own stellar system, the Andromeda nebula must necessarily be one also. There is other evidence against the extragalactic hypothesis. The dark streak which is seen across the middle of those spirals which are turned edgewise to us is explained as being due to obscuration by dark matter collected at the outside edge of the whirl. This would hardly be likely to exist if the nebula was composed of individual stars. Again the fact that a certain photographic filter screen cuts off a great percentage of the light from the arms than from the center tends to show a gassy nature in the emitting source. However, no argument seems as convincing as distance data. It is interesting to note that within the last 25 or 30 years a great many novas or "new stars" have been discovered within the spiral nebulas. The number and brightness of these seem to us to be additional evidence against the hypothesis that the spirals are outside of our galaxy.

EVENING SKY MAP FOR SEPTEMBER



AT 9:00 P.M., SEPT. 1 8:00 P.M., SEPT. 15 7:00 P.M., SEPT. 30

Face South and hold the Map overhead, the top North, and you will see the stars and planets just as they appear in the heavens. The arrow through the two stars in the bowl of the Big Dipper points to the North Star, the star at the end of the handle of the Little Dipper. This map is arranged specifically for Latitude 40 North—New York—but is practical for ten or fifteen degrees north or south of this latitude anywhere in the United States, the southern portion of Canada and the northern portion of Mexico and for corresponding latitudes in Europe.

THE MOON AS A CLUE TO THE EARTH'S EARLY HISTORY

BY D. W. ALLAN

The moon and the earth very probably had a common origin and it is possible that studies of the dynamical and tectonic evolution of the former may help in understanding some geophysical and geological problems, especially concerning the very early history of the earth. Erosion is largely absent on the moon because it has little or no atmosphere, and tectonic processes are probably long since at end. Hence it is probable that we are able to see the lunar surface structures dating from the very beginning of its history, and may surmise something as to the corresponding conditions on the primitive earth. Again, the thermal histories of the earth and moon are closely related, and the effect of tidal friction on the moon's motion has been used in the past to give an age for the earth-moon system.

The information we have on the moon is detailed in some respects—e.g. its visible surface is better mapped than regions of the earth—but still very inadequate in others. For example, it has been found possible to argue over something as fundamental as the nature of the surface material which makes up the maria; one view is that they consist of

rock powder or dust which has settled into flat plains in the low portion of the moon; the other that they are great lower floors. The problem is closely related to the moon's thermal history, and an important fact to be considered in studying the latter is the non-equilibrium shape of the moon; it possesses a "bulge" towards the earth which would not be maintained if the interior were molten or near the melting-point. As mentioned, the tides have an important long-range effect on the earth-moon system, for they transfer angular momentum and have caused the moon to recede from the earth: rough estimates of the rate of recession are compatible with present estimates of the age of the earth.

The first question that comes to mind in comparing the moon and earth is why the craters are so numerous on the one and lacking on the other. Attempts to explain them as volcanic features have not been convincing, and if they are considered, as is usual, to be due to explosive meteoritic impacts it might be concluded either that both the moon and earth suffered intense bombardment early in their history (all traces now being gone from the earth, in line with

the fact that the oldest rocks known are 3×10^9 years), or that the moon has somehow experienced a more intense bombardment than the earth.

The origin of the maria brings in the problem of the moon's thermal history. The largest of these, Mare Imbrium, is almost certainly the result of an enormous impact. There are difficulties in the way of explaining them all as impact features filled with "dust", not lava, for if the moon has always been cold the radio-active elements would be distributed uniformly throughout and, according to the latest estimates of radio-activity in meteorites, would have raised its interior nearly to the melting point. This might indicate that radioactivity in meteorites does not give average values for the moon or earth. On the other hand, if there has been volcanism on the moon (for which there is some visual evidence) and the maria are to be explained as lava flows, then another thousand million years or so must be added to its age for radioactive heating to have taken place, and there are difficulties in understanding the relationships of the earth's and the moon's ages and the time of formation of the lunar features.

This brief sketch of some problems of lunar history has attempted to show how they bear on such geophysical matters as the age of the earth, concentrations of radio-activity, and even oceanic tides. It would indeed be desirable for more geophysicists to join the astronomers in studying our fascinating, though perplexing satellite.

—*Journal of the Royal Astronomical Society of Canada*

THE ROTATION PERIOD OF VENUS

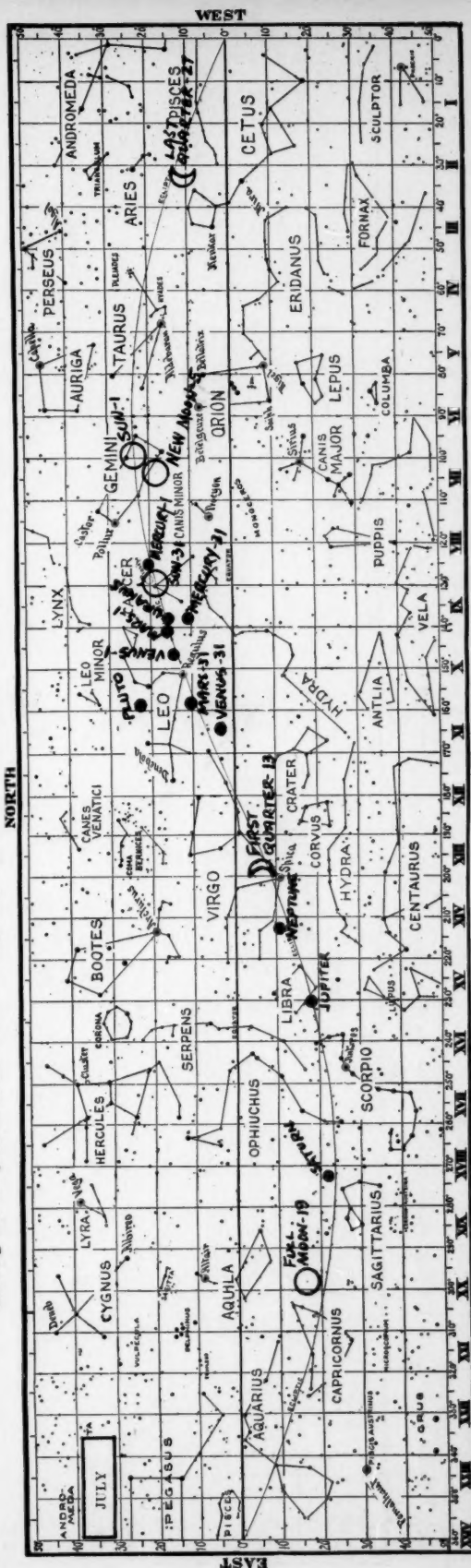
In a letter to *Nature* in the September 29th, 1956 number, John D. Kraus of the Radio Observatory of Ohio State University has announced that an analysis of radio pulses received from Venus at a wave-length of 11 metres points to a rotation period of 22 hr. 17 min. for the planet. Kraus has found that the radio noise coming from Venus tends to reach a peak about every 13 days. Assuming that this activity is confined to one side of a rotating planet, he might have concluded that the rotation period is 13 days, but in July he observed a distinct pattern repeating itself every day for some days with a delay of about an hour and three-quarters from day to day. This has led him to conclude that the period is really about $22\frac{1}{4}$ hours, the thirteen-day interval really representing a beat period between the rotation of Venus and the rotation of the earth.

The rotation of Venus has presented a vexing problem for many years. F. E. Ross found in 1928 that the visible markings in the cloudy surface of Venus, although suggesting a fairly short rotation period, were too evanescent for firm conclusions to be made, and Slipher and others had found in 1903 that the Doppler shift in the spectrum of the limb of Venus was so small that one could hardly believe that the rotation period was shorter than a few weeks. Ross stated, and it has been commonly repeated in textbooks, that the period is probably about 30 days. The period of $22\frac{1}{4}$ hours now given by Kraus is hard to reconcile with the spectrographic observations, unless it could be that there is a large relative velocity difference between the visible surface of Venus and the parts responsible for the radio signals.

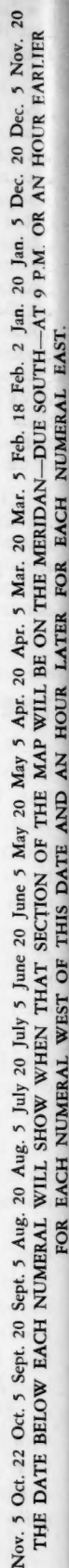
—*Journal of the Royal Astronomical Society of Canada*

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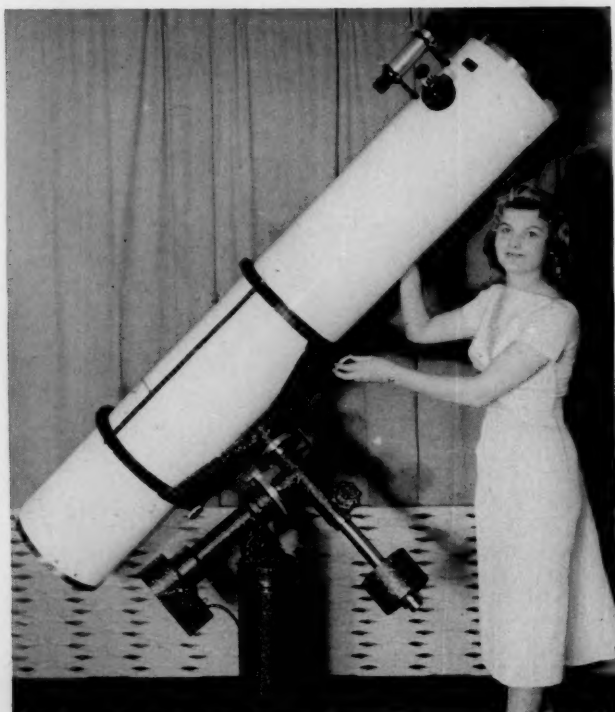
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